Carleton UNIVERSITY

Higgs working group discussion

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Snowmass Energy Frontier Workshop
Brookhaven National Laboratory, April 3-6, 2013

Outline

Deliverables

Snowmass studies in progress

Open questions

Your deliverables to us: table entries and white papers!

Working Group Output

- General coupling fits+ fits within specific models

	LHC300	LHC3000	ILC250	ILC500	ILC1TeV	CLIC 3 TEV	μμ
Δ_H							
Δ_V							
Δ_f							
Δ_b							
Δ_τ							
Δ_V							
…							

See recommendations of LHC Higgs Cross Section Working Group

Snowmass studies in progress: for particular facilities

- ILC + luminosity upgrade

- muon collider

- gamma-gamma collider

- CLIC

- LHC experiments? 300 and 3000 fb^{-1}

- TLEP + VLHC

Please let us know your intentions!

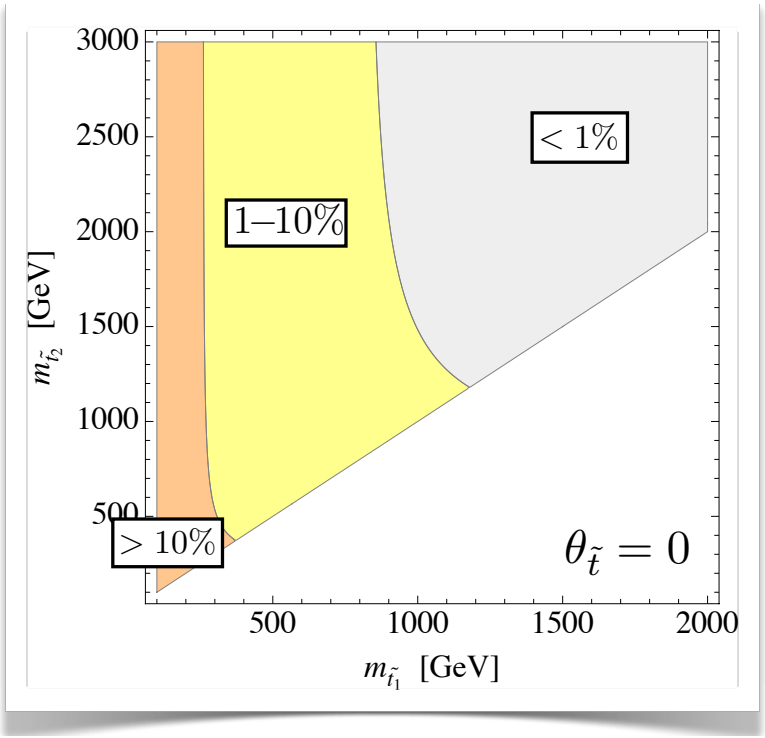
How can we best compare facilities on an equal footing?

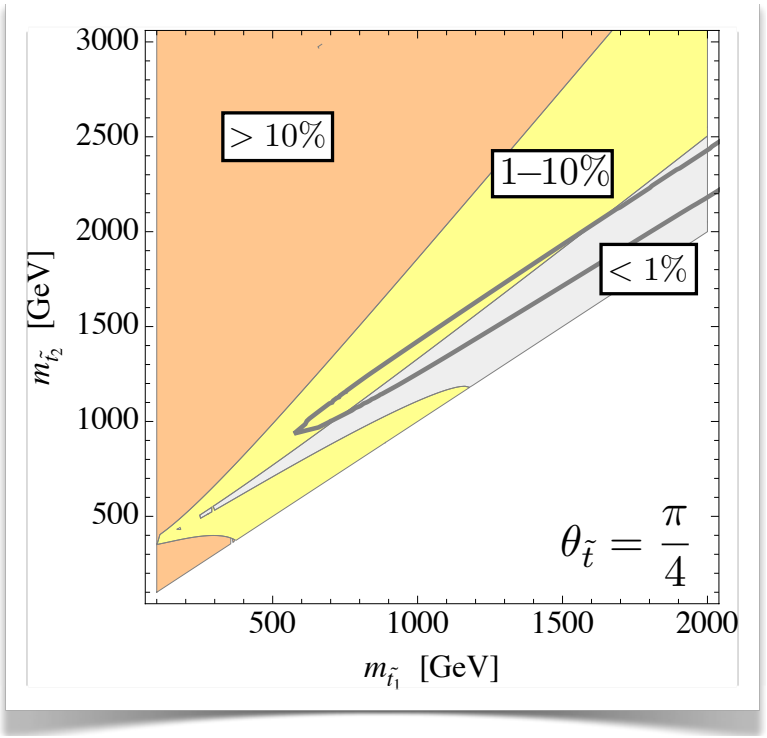
How well we need to measure the Higgs couplings

- Loop-induced couplings (talk by Brian Batell)

Stop

$$\Delta_g^{\tilde{t}} \simeq \frac{1}{4}\left[m_t^2\left(\frac{1}{m_{\tilde{t}_1}^2}+\frac{1}{m_{\tilde{t}_2}^2}\right)-\frac{1}{4}\left(\frac{m_{\tilde{t}_2}}{m_{\tilde{t}_1}}-\frac{m_{\tilde{t}_1}}{m_{\tilde{t}_2}}\right)^2\sin^2 2\theta_{\tilde{t}}\right]$$

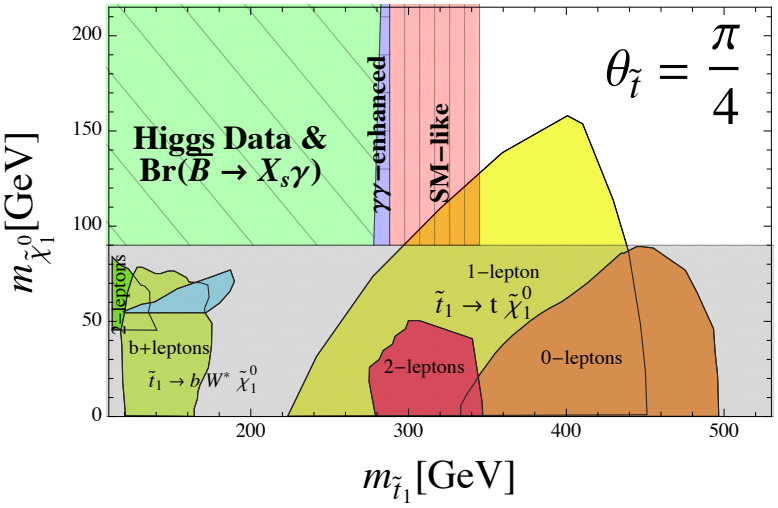




Stop searches and Higgs coupling determination

Veronica Sanz

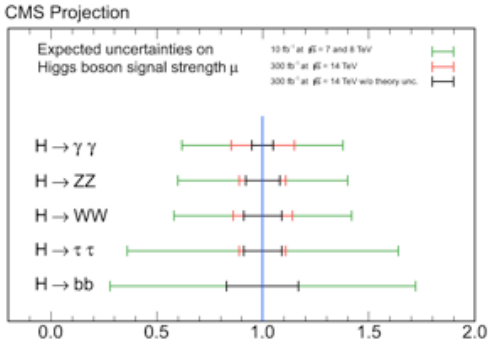
stop exclusion@95%CL using 2012 Higgs data



Note: Higgs-data dominated, quite independent of other observables (b to sgamma, mW), or mixing angle, or final state (MET or no-MET). Valid when tan beta is moderate.

Espinosa, Grojean, VS, Trott, 2012

For snowmass



1. Prospects 300 ifb LHC14
2. Adding staus/sbottoms for large tanbeta
3. Add possible improvements in flavor const
4. ILC/LHC14

How well we need to measure the Higgs couplings

- pMSSM model scan (1-pager from pMSSM group)

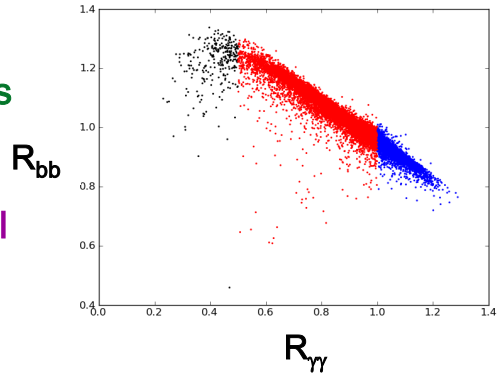
Simultaneous Constraints on Higgs Properties & SUSY Partners in the pMSSM

We will address the questions: "What do direct SUSY searches tell us about the Higgs & what do precision Higgs measurements say about SUSY?" within the context of the pMSSM with either neutralino or gravitino LSPs.

The analysis consists of 2 parts: (i) Determine the 'coverage' of the pMSSM parameter space by the suite of ATLAS (& some CMS) SUSY analyses at 7 & 8 TeV, then extrapolate to 14 TeV. We then use these results to constrain possible deviations in Higgs properties from SM expectations.

(ii) Use the current & extrapolated precision on LHC/ILC Higgs signal strength measurements to extract constraints on sparticle properties.

These analyses will be performed using several existing & one new pMSSM model sets



SLAC NATIONAL ACCELERATOR LABORATORY

M.W. Cahill-Rowley, J.L. Hewett, A. Ismail & T.G. Rizzo

- Simple benchmark models (benchmarks talk by Sally Dawson)

Extended Higgs Sectors

- Many models have more than one Higgs boson
- As a representative set, we will consider:
  - Models with an additional Higgs Singlet
  - Composite Higgs Models
  - 2 Higgs Doublet Models
    - MSSM and NMSSM

Open questions

- CPV Higgs couplings: relation to EDMs? relation to electroweak baryogenesis?

- Higgs and dark matter: what can be learned? (direct detection? colliders?)

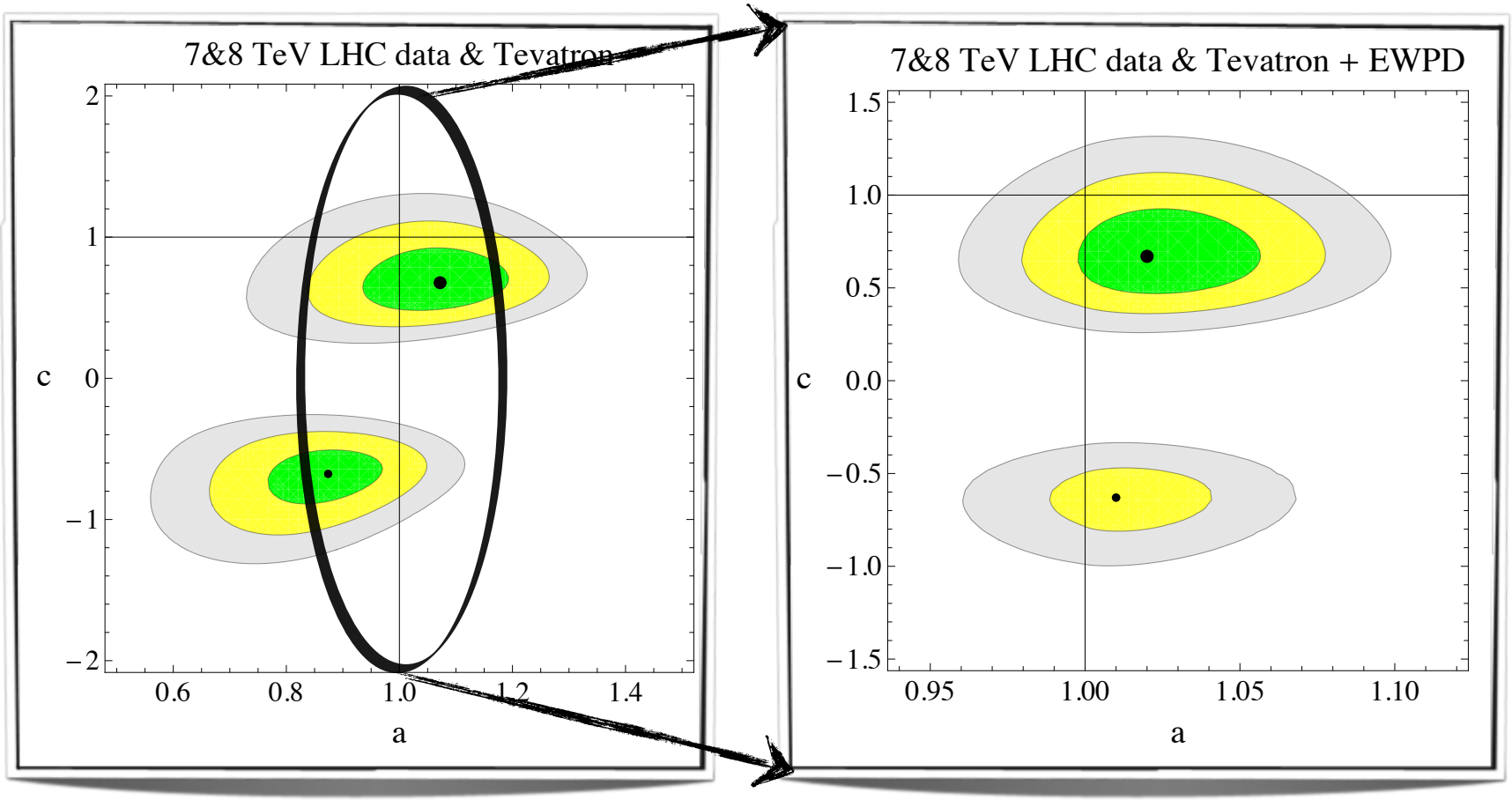
- Higgs couplings vs. electroweak measurements (complementary constraints on dimension-6 operators?)

- What do we learn from the Higgs self-coupling measurement? (BSM benchmarks? EWBG?)

If you have a great idea of something to study for Snowmass, send us a 1-pager proposal and plan to submit a white paper!

RG-Higgs physics: Don't forget LEP!

Espinosa, Grojean, Muhlleitner, Trott '12



EW data prefer value of 'a' close to 1

backup slides